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EPA (Environmental Protection Agency) Evaluation of the Kamei Spoilers under Section 511 of the Motor Vehicle Information and Cost Savings Act

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Ann Arbor, MI

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16. ABSTRACT

This document announces the conclusions of the EPA evaluation of the Kamei Spoilers under the provisions of Section 511 of the Motor Vehicle Information and Cost Savings Act.

The evaluation of the Kamei Spoilers was conducted upon the application of the manufacturer. The Kamei Spoiler is a plastic spoiler (or air dam) that is about six inches high and extends the width of the vehicle. Thespoiler is installed beneath the front bumper to reduce the flow of air under the front of the vehicle. The device is claimed to reduce the aerodynamic drag forces retarding a vehicle and thereby improve fuel economy. EPA fully considered all of the information submitted by the applicant. The evaluation of the Kamei Spoilers was based on that information and EPA's engineering judgement. The overall conclusion is that the Kamei Spoilers have the potential to improve the fuel economy of some motor vehicles.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Aerodynamic Drag Exhaust Emissions Fuel Consumption Motor Vehicles	Fuel Economy Spoiler	

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by
Edward Anthony Barth

March 1983

Test and Evaluation Branch
Emission Control Technology Divison
Office of Mobile Sources
U.S. Environmental Protection Agency

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EPA Evaluation of the Kamei Spoilers Under Section 511 of the Motor Vehicle Information and Cost Savings Act

The Motor Vehicle Information and Cost Savings Act requires that EPA evaluate fuel economy retrofit devices and publish a summary of each evaluation in the Federal Register.

EPA evaluations are originated upon the application of any manufacturer of a retrofit device, upon the request of the Federal Trade Commission, or upon the motion of the EPA Administrator. These studies are designed to determine whether the retrofit device increases fuel economy and to determine whether the representations made with respect to the device are accurate. The results of such studies are set forth in a series of reports, of which this is one.

The evaluation of the "Kamei Spoilers" was conducted upon the application of the manufacturer. It is a plastic spoiler (or air dam) that is about six inches high and extends the width of the vehicle. The spoiler is installed beneath the front bumper to reduce the flow of air under the front of the vehicle. The device is claimed to reduce the aerodynamic drag forces retarding a vehicle and thereby improve fuel economy.

1. Title:

   Application for Evaluation of Kamei Spoiler Under Section 511 of the Motor Vehicle Information and Cost Savings Act

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The information contained in Sections two through four which follow was supplied by the applicant.

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2. Identification Information:

   a. Marketing Identification of the Product:

      KAMEI

   b. Inventor and Patent Protection:

      (1) Mr. Karl Meier
      Kamei GmbH & Co
      Postfach 100539
      Heinrichswinkel 2
      3180 Wolfsburg II
      West Germany

      (2) Patent-A copy of the patent was not provided

c. Applicant:

(1) Kamei USA, Inc.
300 Montowese Avenue
North Haven, Connecticut 06473

(2) Mr. Joseph J. Mongillo, President
Mr. Uwe Meier-Andrae, Vice President
Mr. Klaus Meier, Treasurer

(3) Mr. Ralph Hansen or Mr. Robert E. White are authorized to represent Kamei USA, Inc. in communication with EPA

d. Manufacturer of the Product:

(1) Kamei USA, Inc.
300 Montowese Avenue
North Haven, Connecticut 06473

(2) Mr. Joseph J. Mongillo, President
Mr. Uwe Meier-Andrae, Vice President
Mr. Klaus Meier, Treasurer

3. Description of Product:

a. Purpose:

"Reduction of fuel consumption
Decrease of aerodynamic drag coefficient"

b. Applicability:

(1) "Vehicle application information is included in the attached pricing schedule and catalogue." The pricing schedule was not supplied with the application but was provided later. The models listed in Attachment A were extracted from this catalog.

(2) "Product may be used under all driving conditions."

c. Theory of Operation:

"The addition of a Kamei spoiler to a known vehicle produces the following effect: controls the amount of air that is allowed to pass under the vehicle. This process reduces the amount of drag caused by the air. In addition, by reducing the air volume you reduce the amount of lift caused by the air. The air is passed over the top of the vehicle, and directed around the side, this additional air direction causes a downward pressure, again decreasing lift over the front axis, and controls wind

buffeting, giving the auto better road adhesion, safer handling, less horsepower needed and more M.P.G. Please see wind tunnel reports reflecting same." The applicant provided simplified test reports on many vehicles. Attachment A summarizes the changes in drag and fuel consumption from these reports and Attachment B is a sample of one of these reports. These data are further discussed in Section 5d(2).

d. Construction and Operation:

"Kamei spoilers are manufactured of top quality high impact A.B.S., manufacturing processing is through a computer controlled vacuum forming machine. This process controls uniformity from item to item. Each spoiler is designed specifically for the vehicle, taking into consideration reduction of drag, lift, crosswind buffeting, crankcase, disc brake, and radiator cooling. The spoiler fits exactly to the fenders and valance of the specific auto. The unit comes complete with mounting instructions and fastners. Average installation time is 15 minutes. See pictures of header cards." The 6 by 14-inch header cards identified the spoilers and had the installation instructions printed on the reverse side. The applicant subsequently provided samples of these for 55 vehicles.

e. Specific Claims for the Product:

"Wind tunnel testing provides the proof that Kamei front spoilers decrease the lift coefficient and give your car a better aerodynamic shape. This means your car will have more road adhesion, lower cross wind sensitivity, and greater directional stability. Kamei spoilers also minimize the air drag coefficient which simply means higher driving performance with less fuel consumption and an increased maximum speed."

f. Cost And Marketing Information:

Suggested retail price varies from $63.00 to $176.00 depending on the application.

"The product is marketed through warehouse distributors and then to automotive jobbers/stores who sell to the ultimate consumer"

4. Product Installation, Operation, Safety and Maintenance:

a. Installation - Instructions, Equipment, and Skills Required:

"Installation Instructions Attached" Copies of the Installation Instructions for 55 of the models were provided. A sample of these instructions is given in Section 5c(1).

b. Operation:

"Operating instructions are not necessary for this product."

c. Effects on Vehicle Safety:

"Safety with regard to this product is not a factor."

d. Maintenance

Maintenance was not addressed in the application.

The following sections are EPA's analysis and conclusions for this device.

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5. Analysis

a. Identification Information:

(1) Marketing Identification:

Kamei is the marketing name for the products of the company. The application included information and wind tunnel test data on several different types of aerodynamic devices for a vehicle (front spoilers, rear spoilers, fender flares, side skirts, hood scoops, and sun-roof deflectors). The application was clarified to apply only to front spoilers (see Attachments C and D).

(2) Inventor and Patent Protection:

EPA requested a copy of the patent to aid our understanding of the device (Attachment C). The applicant responded that there were no open patents on the product (Attachment D).

(3) Applicant:

The applicant is the U.S. subsidary of Kamei GmbH and Co., the parent company (Attachment H).

(4) Manufacturer:

The spoilers are manufactured in both Germany and the U.S. In the U.S., the devices are distributed by regional firms that represent the manufacturer.

b. Description:

(1) As stated in Section 3a, the purpose of the Kamei Spoiler is to reduce the aerodynamic drag on a vehicle, thus reducing the power required from the engine and thereby increasing fuel economy. This is in agreement with the theory of operation and design of the device.

(2) The vehicle application list that was given in the catalog adequately described the vehicles to which each model of the device applied. Most of these were small vehicles.

(3) The theory of operation given in Section 3c is adequate, sound, and brief. A more detailed discussion of the aerodynamic effects and their influence on fuel consumption is given in Section 5d(2).

(4) The spoiler is about six inches high and extends the width of the vehicle. The spoiler weighs about five pounds and is made of an ABS plastic that is capped with a matte black material for protection from ultraviolet light. The unit is paintable without special surface preparation or may be left unpainted (Attachment D).

(5) In Section 3e, the applicant claimed the device would improve the fuel economy and performance of a vehicle. These claims are in agreement with the purpose, theory of operation, construction and potential of the device. However, no specific numerical improvements were claimed in this section or in the product literature provided. The test reports which were submitted (Attachments A and B) summarize the changes in the drag and lift forces on a vehicle when the spoilers are installed. These wind tunnel tests also give an estimated improvement in fuel economy and top speed.

(6) The new pricing schedule noted in Section 3b showed a suggested retail prices which ranged from $107.00 to $293.00.

The cost of installation should be less than $10.00 for those users who have the device installed by a mechanic (fifteen minutes labor at $30.00 per hour). However, as noted in Section 5b(1), the installation is relatively easy and most individuals with basic mechanical skills should be readily able to install the device.

c. Installation, Operation, Safety and Maintenance:

(1) Installation - Instructions, Equipment and Skills Required:

The installation instructions are short and clear and are specific for each vehicle. The instructions for a Datsun 240Z are given below and are typical.

"1. Level and align spoiler ends to wheel wells.

"2. Using holes in spoiler as a template, drill through sheet metal with 9/64 bit.

"3. Secure spoiler with #10 plate screws and washers."

The installation of a Kamei front spoiler on a Datsun 240Z was examined by EPA. The spoiler was attached to the valance (front splashpan) with six screws. The spoiler has a groove that permits it to be readily aligned with the valance for the drilling of the six mounting holes in the vehicle.

The installation is simple and can readily be done by persons with average mechanical skills. It will require the use of only a drill and screwdriver and should take no longer than 15 minutes claimed in Section 3d. The installation does not require the removal of the valance or parking lights (see Attachments C and D). The necessary mounting hardware is provided with the spoiler. According to the applicant, it is not necessary to reposition parking lights or turn signals since each is designed to fit without requiring changes (see attachments C and D).

(2) Operation:

Since the spoilers reduce the front end ground clearance, EPA asked the applicant if this reduced clearance caused problems with curbs or parking blocks (Attachment C). The applicant stated that the installed ground clearance ranges between five-and-nine inches with an average of eight-inches. Also, the spoilers are designed to spring back after a three-inch deflection and are made of an impact resistant ABS plastic. If bent farther, the spoiler will snap at the mounting hole, thus preventing structural damage to the vehicle (Attachment D). Therefore, the vehicle should not be damaged if the spoilers are damaged by striking a curb and the spoilers will probably not be damaged in normal vehicle operation.

(3) Effects on Vehicle Safety:

In Section 4c, the applicant made no claims for safety due to the device and indicated safety was not adversely affected. However, the test data showed that the addition of the spoiler reduced the aerodynamic lift on the front of the vehicle. Thus, the safety of the vehicle is improved since the changes in handling and directional stability caused by the lift on the vehicle are reduced. Also, the applicant stated in Section 3c that the device controlled wind buffeting and reduced lift.

The brochure for the spoiler stated that "Each spoiler has passed the coveted West German T.U.V. Safety and Performance Certification Test."

(4) Maintenance:

The application did not address routine maintenance. In response to our inquiry (Attachment C), the applicant stated that the spoilers were maintenance free. We agree with this statement.

d. Effects on Emissions and Fuel Economy:

(1) Unregulated Emissions:

The application did not address unregulated emissions. In response to our inquiry (Attachment C), the applicant stated that the device should have little or no effect on these emissions. Since the device does not change the emission control system of a vehicle, but only changes the engine load a small amount, the device is judged unlikley to adversely affect unregulated emissions.

(2) Regulated Emissions and Fuel Economy:

(a) Data Requirements

The applicant did not submit test data in accordance with the Federal Test Procedure and the Highway Fuel Economy Test. These two test procedures are the primary ones recognized by EPA for evaluation of fuel economy and emissions for light duty vehicles.* The fuel consumption data provided were estimates based on the changes in drag that were measured in the wind tunnel.

Normally, data of this nature are acceptable only for the preliminary evaluation of a device. Furthermore, since the changes listed are small, validation would require a large number of FTP and HFET tests. However, since it has been

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*The requirement for test data following these procedures is stated in the policy documents that EPA sends to each potential applicant. EPA requires duplicate test sequences before and after installation of the device on a minimum of two vehicles. A test sequence consists of a cold start FTP plus a HFET or, as a simplified alternative, a hot start LA-4 plus a HFET. Other data which have been collected in accordance with other standardized procedures are acceptable as supplemental data in EPA's preliminary evaluation of a device.

demonstrated that a change in road load could be correlated with a change in fuel consumption, EPA determined that, for this device, it would be appropriate to evaluate the device based solely on substantiating wind tunnel test data.*

(b) Data Submitted

The test data submitted by the applicant consisted of 30 test reports, each similar to Attachment B.** These reports give the percentage change in the drag force that was measured in the wind tunnel and the calculated percentage change in fuel consumption, generally one to two percent. This limited summary of the test results does not allow a person evaluating the spoilers to perform complete review of the data. Therefore, EPA requested additional test details, a sample of the complete calculations for one vehicle that was tested and a copy of the calculations that are used to translate the measured percentage change in the drag force to an estimated percentage change in fuel consumption (Attachments C and D).

The applicant supplied additional test reports and some test details. However, the applicant did not supply all of the necessary requested information (Attachment H). Therefore, our analysis and evaluation was based on the information supplied and our review of pertinent literature (references 1 through 33).

(c) Wind Tunnel Testing

This literature showed that wind tunnel tests are a reliable means of evaluating drag and lift forces on a vehicle. The testing is repeatable and small changes in

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*EPA analyzed the mpg sensitivity of several hundred 1975-78 vehicles to changes in road load horsepower. The FTP and HFET showed respectively, a -.16% and -.33% change in mpg for each percentage change in road load. i.e., a 3% reduction in road load causes a (-3) x (-.33)=1% improvement in mpg for the HFET (reference 23). Also extensive work by Volkswagen has shown that a 3% reduction in drag would result in approximately a 1% improvement in fuel economy for the combined FTP/HFET (reference 15).

**These reports are summarized in Attachment A. Approximately forty other similar test reports were also supplied. These test data are not listed since they were for rear spoilers, front and rear spoilers together, or other aerodynamic devices.

these forces can be readily detected. The many test facilities have correlated well with one another in tests conducted on specially prepared correlation vehicles. The drag forces measured in wind tunnel tests have been duplicated in road tests. Also, the changes in drag force have been correlated to changes in fuel consumption for both the FTP and HFET driving cycles.

This literature also revealed that there are many details of the testing that need to be considered when comparing drag test results. Among these are:

(i) There is no standard wind tunnel test procedure.

(ii) There are production vehicle differences in drag force of up to four percent due to production tolerances for trim, fit, and finish.

(iii) The data from each wind tunnel are corrected for ground plane, blockage, and other test facility effects. The correction factors are different for each tunnel and the magnitude of these corrections can be as large as the measured change in drag forces.

(iv) Small changes in apparently similar vehicle configurations can appreciably affect the results. Items such as the vehicle pitch angle, ground clearance, external accessories, tire size, wheel covers, radiator size, and air-conditioned or non air-conditioned are important to hold constant in comparing wind tunnel results.

The literature contains several reports and articles on front spoilers. This information shows that even small changes, some barely noticeable, in the design of a spoiler can greatly affect the drag force. Conversely, some rather noticeable changes may not appreciably alter the drag. A device such as a spoiler must have the proper height, and location to achieve optimum benefits. Small changes in the height and location can appreciably reduce the benefit or cause adverse effects. Each spoiler needs to be tested on the specific vehicle for which it is designed. Thus, there is no reason to expect an untested spoiler to reduce drag and improve fuel economy because it is also possible the opposite effect could occur.

(d) Comments on Wind Tunnel Testing

The coefficient of drag, Cd, is the number popularized in wind tunnel testing. However, the effect on fuel economy is due to the drag force which is the product of the drag coefficient, frontal area, and dynamic pressure. This pressure is a function of vehicle speed and atmospheric density. Therefore, a more meaningful comparison between vehicles is to compare the product of frontal area and drag coefficient.

The literature supplied by the applicant states that the spoilers are wind tunnel tested on all vehicles for which they are designed. This in fact was not always the case. The basic shape used for one spoiler model may be used for several vehicle models of one manufacturer and even for the vehicles of other manufacturers. Not all of these configurations have been tested. Therefore, because of the sensitivity of aerodynamic devices to size, location, and overall vehicle shape, there is no reason to believe that one basic design will have the same effect on several vehicles.

(e) Vehicle Design

The final consideration on the potential effectiveness of a spoiler is the operating variables.

(i) The device will only improve fuel economy if it is able to reduce drag. A vehicle with poor aerodynamics, and thus high drag forces may benefit more from the device than one which is already aerodynamically sleek.

(ii) The vehicle manufacturers are now giving greater attention to reducing vehicle drag. Changes made to the front of a vehicle to improve the aerodynamics will limit the effectiveness of an aftermarket spoiler.

(f) Operating Variables

The effectiveness of a spoiler will depend on both the percentage reduction in the aerodynamic drag force and vehicle speed. At speeds above 35 mph, drag is the largest retarding force.* Since drag is directly proportional to the square of speed, it becomes an even larger percentage of the retarding forces as speed increases. Therefore, a spoiler will have a greater effect at highway speeds than at urban speeds.

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*These retarding forces are engine and drivetrain friction, rolling resistance and aerodynamic drag.

(g) Cost Effectiveness

The improvements in fuel economy due to the spoilers were small, typically one or two percent. For a vehicle initially achieving 30 mpg, and gasoline selling at $1.40 a gallon, it would take over 125,000 miles to recover the cost of a $100 spoiler if a two percent improvement were achieved.

(h) Effect on Emissions

The small reduction in engine load, due to the reduced drag forces, should have minimal effect on regulated emissions.

6. Conclusions

EPA fully considered all of the information submitted by the applicant. The evaluation of the Kamei Spoilers was based on that information and our engineering judgment. The overall conclusion is that the Kamei Spoilers have the potential to improve the fuel economy of some vehicles.

The amount of this fuel economy benefit depends on several factors. The most important is the percentage reduction in the drag force due to the spoiler. Vehicles for which the device is well matched will likely experience an improvement in fuel economy. The second important factor is the type of driving cycle. The device will be more effective in highway driving than urban driving. Since a typical improvement in fuel economy would be one or two percent, it is unlikely the cost of the unit would be offset by fuel savings during the life of the vehicle.

This reduction in engine load due to the spoilers (and small increase in fuel economy) should have a minimal impact on emissions. Installation is quick and simple and could be accomplished by most owners.

FURTHER INFORMATION CONTACT: Merrill W. Korth, Emission Control Technology Division, Office of Mobile Sources, Environmental Protection Agency, 2565 Plymouth Road, Ann Arbor, MI 48105, (313) 668-4299.

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List of Attachments

Attachment A Kamei Front Spoilers - Availability and Summary of the Drag and Fuel Economy Effects.

Attachment B Wind Tunnel Test Report.

Attachment C Letter of March 23, 1982 from EPA to Joseph Mongillo of Kamei USA, Inc. requesting information missing from application, clarification, and additional information.

Attachment D Letter of May 5, 1982 from Joseph Mongillo of Kamei USA, Inc. to EPA responding to EPA request.

Attachment E Letter of May 17, 1982 from Joseph Mongillo of Kamei USA, Inc. to EPA responding to phoned and written requests by EPA for information.

Attachemnt F Letter of July 9, 1982 from Joseph Mongillo of Kamei USA, Inc. to EPA providing wind tunnel data.

Attachment G Letter of October 4, 1982 from EPA to Joseph Mongillo of Kamei USA, Inc. discussing information supplied by Kamei.

Attachment H Letter of October 18, 1982 from Joseph Mongillo of Kamei USA, Inc. to EPA discussing test results submitted by Kamei.

Attachment A

Kamei Front Spoilers
Availability and Summary of Drag and Fuel Economy Effects

Vehicle	Model, Year	Front Spoiler Part No.	Test* Vehicle	Test Report No.	Percent Change Drag	Percent** Change Fuel Consumption
Audi	Fox, all	4 4231	Audi 80, Type 82	23	-5%	-1.9%
	4000, 8/78-80 Sedan only	4 4233	Audi 80, Type 80	68	-5%	-1.6%
	Coupe and 5+5	4 4234				
BMW	2002, all	4 4220	BMW 2002 2 dr.	26	-5%	-1.7%
	320i, thru 1979	4 4221	BMW 3 series	39	-3%	-1.1%
	320i, 1980-81	4 4222	BMW 3 series	58	-2%	- .7%
		4 4600	BMW 3 series	65	-2.3%	- .8%
	528, 530i, all	4 4223	BMW 5 Series	42	-2%	- .8%
Cheverolet	Chevette, 1974-81	4 4540				
	Camaro, 1974-77	4 4541				
	Camaro, 1978-81	4 4542				
Datsun	240Z, 260Z, up to 6/74	4 4281				
	210, 1978-79	4 4282				
	510, 1979	4 4284				
	Maxima, 1981	4 4516				
	310 GX, 1980	4 4517				
	210, 1980	4 4518				
	200SX, 1979-81	4 4519				
	280ZX	4 4520				
	260Z, after 6/74, 280Z	4 4521				
	210, pre-1978	4 4522				
	510, 1980	4 4523				
Dodge	Colt, 1980 up	4 4545				
	Omni, 4 door only	4 4215	Simca Horizon	22	-6%	-2.2%
Ford	Escort	4 4255	Escort	60	-1%	- .4%
	Fiesta, all	4 4256				
	Mustang/Capri, 1979-81	4 4257				
	Escort/Lynx, 1980-81	4 4258				
	Mercury Capri II, thru 1978	4 4260				
Honda	Civic, 1980	4 4273				
	1500, Civic, 1979	4 4274				
	Civic model 1200, only	4 4275				
	Accord, thru 1978	4 4276				
	Accord, 1979 up	4 4277	79 4dr Accord	4	-1%	- .4%

Kamei Front Spoilers
Availability and Summary of Drag and Fuel Economy Effects (cont.)

Vehicle	Model, Year	Front Spoiler Part No.	Test* Vehicle	Test Report No.	Percent Change Drag	Percent** Change Fuel Consumption
Mazda	RX7, all thru 1980	4 4500	RX7	45	-1%	- .3%
	323 GLC, 1979-80	4 4501				
	626, 1979-81	4 4502				
	GLC, 1981	4 4503				
Mercedes Benz	DB W123	4 4555	4dr Sedan	134	-2.8%	-1.0%
	DB S123	4 4555	Wagon		-6.5%	-----
Opel	Ascona	4 4241	Ascona	30	-2%	- .6%
	Manta	4 4243	Manta	33	-4%	-1.4%
	Kadett	4 4244	Kadett-C	13	-6%	-2%
	Kadett	4 4246	Kadett-D	61	-4%	-1.4%
Plymouth	Horizon, 4 door only	4 4215	Simca Horizon	22	-6%	-2.2%
	Champ, 1980 up	4 4535				
Renault	Le Car, all to 1979	4 4265	Renault 5	50	-8%	-2.9%
	15/17 Gordini	4 4271				
Subaru	all to 1979	4 4510				
	1980-81	4 4511				
Toyota	S-R5, 1976-79, Sport Coupe	4 4524				
	Celica, pre 1976	4 4525				
	Celica, 1980-81	4 4526				
	Corolla Sedan, 1980-81	4 4527				
	Corolla, 1975-79Sedan/Wagon	4 4528				
	Tercel, 1980	4 4529				
	Corolla S-R5, Sport Coupe	4 4531				
	Supra, 1979-81	4 4532				
	Celica, 1976-77 only	4 4533				
	Tercel, 1981	4 4534				
	Celica, 1978-79	4 4283	Celica Coupe	7	-1%	- .5%
Volkswagen	Super Bettle, all	4 4210	Super Bettle	36	-4%	-1.5%
	Custom Bettle	4 4211				
	Scirocco, all thru 1981	4 4225	Scirocco	10	-3%	-1.1%
		4 4226	Scirocco	156	-3.3%	-1.2%
	Dasher, 1979-81	4 4232	Passat	53	-7%	-2.6%
	Rabbit, w/o ducts, all + P/U truck	4 4235	Rabbit	38	-4%	-1.3%

Kamei Front Spoilers
Availability and Summary of Drag and Fuel Economy Effects (cont.)

Vehicle	Front Spoiler Model, Year	Test* Part No.	Test Report Vehicle	Percent Change No.	Percent** Change Fuel Drag	Consumption
	Rabbit, w/ducts, all + P/U truck	4 4236	Golf Cabriolet	1	-3%	-1.1%
		"	Golf Sedan	2	-4%	-1.4%
		4 4610	Golf Sedan	125	-3.3%	-1.1%
		4 4250	Polo	55	-1%	- .5%
	Rabbit, New Style, twin ducts	4 4237	Golf Sedan	54	-5%	-1.7%
	Jetta, all	4 4570	Jetta	79	-2.4%	- .8%

*The tests were performed on the vehicles of the same configuration. The differences in names between the applicable model vehicle and the test vehicle was because usually a European version of a vehicle was tested, i.e., VW Golf is the same as a VW Rabbit.

**Percent change in fuel consumption was not actually measured but was calculated using VW's emperical equations to relate the measured change in drag to the change in fuel consumption.

KAMEI

TECHNISCHE ENTWICKLUNG
TECHNICAL RESEARCH
WOLFSBURG

TESTREPORT

WINDKANAL
WIND TUNNEL

BERICHT NR. / REPORT NO.: 4
DATUM / DATE: 10.7.79
R. Wiebels
DIPL.-ING. R. WIEBELS

VERSUCHSFAHRZEUG / TEST CAR:

Honda Accord '79 Stufenheck/notchba
155 R 13

FRONTSPOILER / FRONT SPOILER

KAMEI Typ 4 4277

GEPRÜFT IN / TESTED IN: Wolfsburg
DATUM / DATE: 24.04.1979

VERBESSERUNGEN DURCH SPOILER / IMPROVEMENTS BY SPOILER:

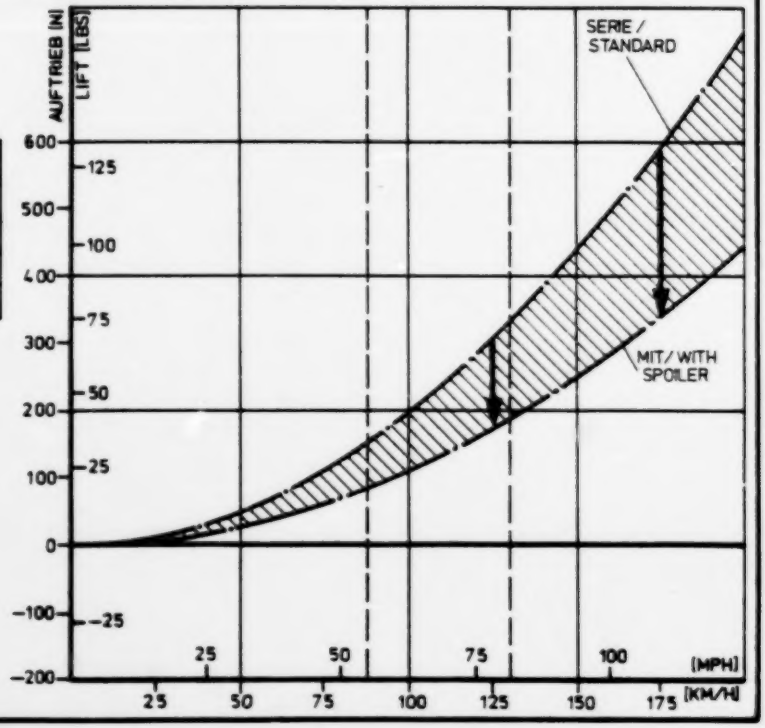
1. VERRINGERUNG DES LUFTWIDERSTANDSBEIWERTES „C_W"
DECREASE IN AERODYNAMIC DRAG COEFFICIENT „C_D": MINUS 1 %

2. HÖHERE GESCHWINDIGKEIT ENTSPRECHEND GEWINN AN LEISTUNG „N"
HIGHER TOP SPEED ADEQUATE TO INCREASE IN PERFORMANCE „P": PLUS 2 %

3. VERRINGERUNG DES KRAFTSTOFFVERBRAUCHS „ΔB", GEMISCHTER BETRIEB
REDUCTION OF FUEL CONSUMPTION „ΔFC", COMBINED DRIVING CONDITIONS: MINUS 0,4 %

4. VERRINGERUNG DES AUFTRIEBSBEIWERTES AN DER VORDERACHSE „C_{AV}"
DECREASE IN LIFT COEFFICIENT ON FRONT AXLE „C_{LF}" MINUS 42 %

AUFTRIEB / LIFT	SYMBOL
VORN / FRONT	—·—
HINTEN / REAR	— — —



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
ANN ARBOR, MICHIGAN 48105

March 23, 1982

OFFICE OF
AIR, NOISE AND RADIATION

Mr. Joseph J. Mongillo, President
Kamei USA, Inc.
300 Montowese Avenue
North Haven, CT 06473

Dear Mr. Mongillo:

We received your letter of February 25, 1982 in which you applied for an EPA evaluation of the KAMEI Spoilers as a fuel economy retrofit device.

Our sample application format documents consists of three pages that divide the application into five sections. Your application directly addressed only sections 1 through 4d. I presume you did not have page 3 which covers maintenance, unregulated emissions, regulated emissions, and fuel economy. Enclosed is a complete copy of our application format.

Our Engineering Evaluation Group has made a preliminary review of your application and has identified several areas that require additional information prior to further processing. Our comments below address each section individually.

1. Section No. 2b. - Please provide a copy of the patent in English.

2. Section No. 3c. - What are typical weights of the front spoilers? Rear spoilers? Fender flares? Side skirts?

3. Section No. 3c. - Are the devices available in color or must they be painted as a part of the installation?

4. Sections No. 3e. and 4a(1) - This section provided only a range of costs but stated that a pricing schedule was attached to your application. However, none was received.

5. Section No. 4a(1) - For which vehicles is the universal rear spoiler, part no. 44410, applicable? For which vehicles is the universal rear spoiler, part no. 44420, applicable?

6. Section No. 4b. - Your application stated that a copy of the installation instructions was attached, however none was received. Please provide a copy of the installation instructions for both front and rear spoilers.

7. Section No. 4b. - Is removal of a vehicle's front splash pan required to install the front spoiler on any vehicles? Please identify any vehicles.

8. Section No. 4b. - Is it necessary to reposition parking lights or turn signal lights on any vehicles to install the front spoiler? Please identify any such vehicles.

9. Section No. 4c. - What is the installed ground clearance of the front spoiler? Are there any problems with ground clearance due to curbs or parking blocks?

10. Section No. 4e. - Maintenance was not addressed, I presume this was because you did not receive a full copy of the application document. I assume no maintenance is required. Is this correct?

11. Section No. 5a. - Unregulated emissions was also not addressed. I presume that you expect no effect on unregulated emissions. Is this correct?

12. Section No. 5b. - Regulated emissions and fuel economy also was not directly addressed although the enclosed test reports did provide results of some wind tunnel testing. There are several areas that need additional clarification or information.

    a. The 29 test reports you provided are numbered 1 through 53. Report numbers 3, 11-19, 23, 24, 25, 29, 30, 31, 33, 34, 35, 37, 47, 49, 51, and 52 (24 reports) were not included. Please provide a copy of these missing reports as well as any which have been conducted more recently.

    b. The information brochures you provided notes that the spoilers are wind tunnel tested on all vehicles for which they are designed. The test data you provided covered only approximately one-third of the vehicles for which you sell spoilers. Please provide the test data for all vehicles and part numbers not deleted on the enclosed part number listing.

    c. The universal rear spoilers appear to apply to several vehicles. Please provide the test reports for those universal models identified in paragraph 6 not previously provided (Reports 5, 6, 32, 40, 41, 43, and 44 were provided with the application).

    d. Please describe the wind tunnel testing with respect to:

        (1) Replication of tests.
        (2) Wind speeds.
        (3) How lift is calculated.
        (4) How drag is calculated.
        (5) Sample calculation for a test report showing test data for both baseline and spoiler configurations.
        (6) Any data showing correlation of wind tunnel drag results with chassis dynamometer fuel economy and road fuel economy.

e. You stated on page 2 of your information letter of October 16, 1979 that "We determine fuel economy according to Volkswagen-Research Division investigations for EPA COMBINED CITY AND HIGHWAY DRIVING".

Please provide a copy of the applicable document(s) and note any specific changes or simplifications that are incorporated for your use.

f. Have you done any fuel economy measurements under controlled test conditions to determine the fuel economy benefits of your spoilers? Please briefly describe any testing and provide fuel economy results on each vehicle.

I realize that you may not be able to immediately supply all of the information requested. However, in order that we may efficiently assist you, I ask that you provide as much of this information as possible in your reply and note when the remainder will be available.

This information will be necessary to further process your request for evaluation. In order for us to conduct our evaluations efficiently, we have established a schedule for each. I ask that you respond to this letter by April 24. If you have any questions or require further information, please contact me.

Sincerely,

Merrill W. Korth
Device Evaluation Coordinator
Test and Evaluation Branch

Enclosures (3)

Rec'd 5-10-82
mmlc

ATTACHMENT D

24

KAMEI USA Inc.
AUTO EXTRAS

P.O. 426 • 300 Montowese Ave. • North Haven, CT. 06473
Phone: (203) 777-6675 • Telex 96-6468 "Kamei USA"

May 5, 1982

Mr. Merrill W. Korth
Environmental Protection Agency
Device Evaluation Coordinator
Tests Evaluation Branch
Motor Vehicle Admissions Lab
2565 Plymouth Road
Ann Arbor, Michigan 48105

Dear Merrill,

With respect to our conversation of May 3, 1982 and your letter dated March 23, 1982. First I would like to thank you for clarifying many points in question. I will respond to each item of your letter.

Item I Section 2B

To the best of my knowledge there are no open patents on the spoilers we are discussing.

Item II Section 3C

The average weight of our spoilers are approximately four and a half to five pounds.

Item III Section 3C

The spoilers come in a matte black A.B.S. capped material that is paintable without special preparation.

Item IV Section 3E & 4A

The average retail price of our front spoiler is approximately $ 100.00. We will forward a price schedule of same, please note that the retail price is suggested and no one pays full retail this is understood.

Item V Section 4A

We should forget about the rear spoiler application for now this will be a separate project by it self.

Item VI Section 4B

We will supply header cards with instructions.

Item VII Section 4B

It is not necessary to remove the valance or other sheet metal from the vehicle to install a spoiler, however if the valance has been damaged many people remove it and replace the damaged valance with a spoiler this is not applicable on all vehicles.

Item VIII

No. Our spoilers are designed with consideration for parking lights, etc.

Item IX Section 4C

The average ground clearance of our spoiler is 8 inches there is no problem with curbs unless the vehicle has been lower, however some ground clearance will run from 5 inches to 9 inches a 5 inch ground clearance spoiler will hit a six inch curb however so will the undercarriage of the vehicle. Our spoilers are designed to be not sensitive after a three to four inch deflection they will snap at the side mounting hole. This will eliminate any structural damage.

Item X Section 4E

The A.B.S. material we use is U.V. stabalized by capped material and leaves the spoiler maintenance free.

Item XI Section 5A

There should be little or no effect on emissions, however considering the fact that the addition of a proper spoiler will reduce fuel consumption and allow the vehicle to travel with less resistance using less horsepower. One might conclude less emissions.

Item XII Section 5B

A. Many of the new spoilers have not yet been put through the wind tunnel, also some spoilers have been modified and not yet retested, although all are designed to meet positive wind tunnel results. If necessary we will leave out these spoilers yet to be tested, and submit them when we have the test results.

B. We will supply the latest test reports on the additional spoilers tested since our last report.

C. We will hold off on the rear spoiler as previously stated, unless you feel it will be beneficial at this time.

D. Item 1 - 6 Please see enclosed wind tunnel test report explanation.

Merrill again I fully appreciate your time, consideration and help on this program.

If we at Kamei can be of further assistance, please do not hesitate to call us at (800) 243-1792.

Sincerely,

Joseph J. Mongillo
President

JJM/nra

KAMEI USA AUTO EXTRAS Inc

P.O. 426 • 300 Montowese Ave. • North Haven, CT. 06473
Phone: (203) 777-6676 • Telex 96-6468 "Kamei USA"

May 17, 1982

Mr. Tony Barth
Environmental Protection Agency
Device Evaluation Coordinator
Motor Vehicle Admissions Lab
2565 Plymouth Road
Ann Arbor, Michigan 48105

Dear Mr. Barth,

With respect to our recent conversation and request for additional information. Enclosed please find some additional and new wind tunnel test reports. Also enclosed please find a list of our original spoilers indicating what other spoilers are made from the basic unit and a brief note of the reason why we change the part numbers.

In the meantime I have requested the information on item "E" and "F" of page three from Mr. Merrill W. Korth's letter dated March 23, 1982. As soon as I receive this information from Germany I will forward it care of your attention.

Thank you again for your help and consideration in this matter.

Respectfully,

KAMEI AUTO EXTRAS, INC.

Joseph J. Mongillo
President

JJM/nra

cc: Merrill W. Korth

KAMEI USA Inc
AUTO EXTRAS

P.O. 426 • 300 Montowese Ave. • North Haven, CT. 06473
Phone: (203) 777-6676 • Telex 96-6468 "Kamei USA"

July 9, 1982

Mr. Merrill W. Korth
Environmental Protection Agency
Test Evaluation Branch
2565 Plymouth Road
Ann Arbor, Michigan 48105

Dear Merrill,

With respect to our conversation of this afternoon I am enclosing some additional wind tunnel testing reports and procedures, as I mentioned the test reports are in German and I can only hope you will be able to evaluate the results.

When we receive the additional information that addresses Item "E" of your letter dated March 23, 1982, I will forward it in care of your attention.

Thank you again for your time and patience on this project.

Respectfully,

KAMEI AUTO EXTRAS, INC.

Joseph J. Mongillo
President

JJM/nra

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
ANN ARBOR MICHIGAN 48105

OFFICE OF
AIR NOISE AND RADIATION

October 4, 1982

Mr. Joseph J. Mongillo, President
Kamei USA, Inc.
300 Montowese Avenue
North Haven, CT 06473

Dear Mr. Mongillo:

In response to your application of March 3, we have begun to finalize our evaluation of Kamei Spoilers. The purpose of this letter is to outline the positive and negative aspects of our analysis and to document our understanding of some of the pertinent supplemental information you have provided.

Although the information provided in your application supports a generally favorable conclusion about the effectiveness of your spoilers, there are several negative factors. Our comments in these areas stem principally from the fact that the information provided is insufficient to allow an impartial reviewer to verify the benefits you claim. These deficiencies may have been resolved favorably if you had supplied the supplemental information we requested. Our comments below highlight the positive and negative aspects of your product that will be presented in our evaluation:

Positive Factors

1. Although the changes were small, the limited data showed an improvement in fuel economy.

2. The installation is quick and simple.

3. The spoilers are available for, and have been tested on, many vehicles.

Negative Factors

1. The methodology for translating a change in drag in the wind tunnel to a change in fuel economy was not described.

2. The correlation between fuel economy in the wind tunnel and on the road was not explained.

3. The test speeds and method of extrapolating results were not given.

4. The results infer that a change in drag coefficient is the sole effect. Actually, for there to be a reduction in aerodynamic drag, there must be a reduction in the product of drag coefficient and frontal area. The frontal area could increase due to the spoiler.

5. The device was tested principally on small sedans. The benefits for small station wagons and larger cars is unknown.

6. Some basic designs are applicable to several vehicles but yet tested only on one. Because of the sensitivity of aerodynamic devices to size, location, and overall vehicle shape, we have no reason to believe that one model will have the same effect on all vehicles it will fit.

Initially, there were also other negative factors. Some of these were satisfactorily resolved by the supplemental information you provided. Others were resolved by our own efforts. However, the negative factors listed above relate specifically to your spoilers and the actual testing conducted. Thus, we were unable to independently satisfactorily resolve these questions by searching the published literature.

The supplemental information that you provided in your letter of May 17, 1982 contained several listings of spoilers that were grouped according to basic configuration. Because it appeared that several of these groupings were in error, we reviewed the list with you on June 16 and made the necessary corrections. Enclosed is a copy of the groupings as we now understand them.

We are now in the process of finalizing the evaluation of your spoilers. If you have any comments or are now able to supply the information which we requested previously. Please contact me by October 20.

Sincerely,

Merrill W. Korth
Device Evaluation Coordinator
Test and Evaluation Branch

Enclosure

Original Spoiler No.	Vehicle	Spoiler Mfg. From Original Spoiler Tooling	Vehicle
44210	VW Super Beetle	44211	VW Custom Beetle
44223	BMW 528, 530i	44217	BMW 528E
44225	VW Sirocco thru 1981	44273	Honda Civic 1980-82
		44282	Datsun 210 1978-79
		44284	Datsun 510 1979
44260	Ford Capri thru 1978	44523	Datsun 510 1980
44233	Audi 4000 Sedan thru 1982	44519	Datsun 200 SX, 1979-81
		44546	AMC Spirit, Concord AMX, 1979-80
44235	VW Rabbit	44510	Subaru to 1979
		44522	Datsun 210 pre-1978
		44535	Plymouth Champ 1980 up
		44545	Dodge Colt 1980 up
		44536	Toyota Starlet 1981-82
44257	Ford Mustang/ Capri 1979-82	44516	Datsun Maxima
44271	Renault 15/17 Gordini	44527	Toyota Corolla Sedan 1980-81
44274	Honda 1500 Civic 1979	44534	Toyota Tercel 1981-82
		44529	Toyota Tercel 1980
44281	Datsun 240 Z, 260 Z to 6/74	44533	Toyota Celica 1976-77
44283	Toyota Celica 1978-79	44502	Mazda 626 1979-81
		44524	Toyota SR5 1977-79
		44532	Toyota Supra 1979-81
		44503	Mazda GLC 1981-82
		44537	Toyota 1/2 ton pickup 1982
44500	Mazda RX-7 thru 1980	44504	Mazda RX-7 1981-82
44511	Subaru 1980-81	44528	Toyota Corolla 1975-79 Sedan/Wagon
		44501	Mazda 323 GLC 1979-80
		44531	Toyota Corolla SR5 Coupe 1980 up

44560	Audi 5000	44261	Ford Mustang 1974-78
44570	VW Jetta	?	
44275	Honda Civic 1200	44540 44548	Chevrolet Chevette Pontiac T-1000
44255	Ford Escort	44258	Ford Escort/Mercury Capri 1980-81

KAMEI INC.
auto extras
300 Montowese Ave. • P.O. Box 426 • North Haven, CT 06473
Tel.. (203) 777-6676 • Telex 96-6468 "Kamei USA"

October 18, 1982

Mr. Merrill W. Korth
Device Evaluation Coordinator
Test and Evaluation Branch
Environmental Protection Agency
Motor Vehicle Admissions Lab
2565 Plymouth Road
Ann Arbor, Michigan 48105

Dear Mr. Korth,

In response to your letter dated October 4, 1982, and our subsequent conversation of October 14, 1982. I am now in receipt of some additional information from our parent company, Kamei GmbH & Co KG. This information explains how our aerodynamic engineers determine drag, lift, speed and fuel economy.

I am sincerely hopeful this new information will aid in your evaluation of our product.

Should you determine that additional information is necessary please contact myself and I will provide same.

Thanking you again for your time and consideration in this matter.

Respectfully,

KAMEI AUTO EXTRAS, INC.

Joseph J. Mongillo
President

JJM/nra

Enclosures